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Administrative Science Quarterly, Volume 12, Issue 1 (Jun., 1967), 1-47.

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Administrative Science Quarterly

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Paul R. Lawrence and Jay W. Lorsch

Differentiation and Integration in Complex Organizations

This is a comparative study of six organizations operating in the same industrial environment. The subsystems (sales, research, and production) in each organization were differentiated from each other in terms of subsystem formal structures, the member's goal orientation, member's time orientations and member's interpersonal orientations. This differentiation was related to the requirements of the particular subenvironment with which each subsystem dealt. A relationship was found between the extent to which the states of differentiation and integration in each organization met the requirements of the environment and the relative economic performance of the organizations. Within each organization the degree of differentiation of behavior and orientation between the various subsystems was found to be inversely related to the degree of integration obtained between these subsystems. Since this environment required that economically high performing organizations be both highly differentiated and well integrated, an investigation was also made into how effective organizations attained both of these antagonistic states. All six organizations had similar integrative devices (integrating teams and departments), but in the high performing organizations the integrative devices more fully met six determinants of effectiveness, which included such factors as the pattern of influence in the organization and the typical mode of behavior used to resolve conflict.

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CONSIDERABLE attention has recently been devoted to understanding behavior in large organizational systems. Although some of this work has been based on research, it has more typically been general theorizing with little support from research data.¹ Our interest in examining complex organizations is to study more systematically and empirically their internal functioning in relation to the demands of the external environment on the organization and the ability of the organization to cope effectively with these demands, contributing to a theory of the functioning of large organizations based on empirical research.²

BASIC RESEARCH DESIGN

Major Concepts and Questions

The basic concepts used in this examination of the internal functioning of large organizations are *differentiation* and *integration*, the key research question being: What pattern of differentiation and integration of the parts of a large organizational system is associated with the organization's coping effectively with a given external environment? The concepts as used here in relation to organizational studies suggest a return to the central concern of early organizational theorists; i.e., the optimal division of labor given a general organizational purpose.³ More recently, Miller has

¹ For data-based studies see, for example, A. Rice, *The Enterprise and Its Environment* (London: Tavistock, 1963); or T. Burns and G. Stalker, *The Management of Innovation* (London: Tavistock, 1961). For examples of theorizing about behavior in complex organizations see P. Pugh, *et al.*, A Scheme for Organizational Analysis, *Administrative Science Quarterly*, 8 (1963), 289-315; V. Thompson, Bureaucracy and Innovation, *Administrative Science Quarterly*, 10 (1965), 1-20; and E. Miller, Time, Technology, and Territory, *Human Relations*, 7 (1959), 245.

² The exploratory study upon which this research is based is reported in J. Lorsch, *Organization and Product Innovation* (New York: Macmillan, 1965). This article is based on research supported in part by the Harvard University Program on Technology and Society under a long-term grant from the International Business Machines Corporation and in part by a grant from the Ford Foundation to the Division of Research, Graduate School of Business Administration, Harvard University.

³ Some prominent exponents of this approach have been H. Fayol, *Industrial and General Administration* (London: Pitman, 1930); L. H. Gulick and L. Urwick (eds.), *Papers on the Science of Administration* (New York: Institute of Public Administration, Columbia University, 1937); J. D. Mooney and A. C. Reiley, *The Principles of Organization* (New York: Harper, 1939).

used these concepts in theorizing about complex organizations, and Rice has made use of them in the description of his work with an Indian textile firm.⁴

Although our use of these concepts is not new, it does represent an apparent break with some of the current and widely known approaches to the study of large organizations. March and Simon's work reflects a key concern with the issue of inducing contributions from organizational members and emphasizes rationality in organizations.⁵ The writing of Likert and MacGregor reflects a central interest in organizational arrangements for releasing the underutilized energy of individual members.⁶ Argyris' work emphasizes the impact of the organization on individual development.⁷ All of these writers tend to start with the individual as the basic unit of analysis and build toward the large organization, while we are proposing to start with larger, sociological entities—the entire organization and its larger subsystems. But, the divergence from this current literature is more apparent than real, and the return to the questions of classical organization theory is done with a difference. While this study selects sociological entities as the primary focus of analysis, it differs from the classical approach in being based on the premise that the individuals in organizations can best be viewed not as passive instruments of organization, but as feeling, reasoning, and motivated beings.

The importance of the concepts of differentiation and integration to the analytic scheme developed here can best be indicated by the definition of the primary unit of analysis in this study—the organizational system. An *organization* is defined as a system of interrelated behaviors of people who are performing a task that has been differentiated into several distinct subsystems, each subsystem performing a portion of the task, and the efforts of each being integrated to achieve effective performance of the system. *Differentiation* is defined as the state of segmentation of the

⁴ E. Miller, *op. cit.*; A. Rice, *op. cit.*

⁵ James G. March and Herbert A. Simon, *Organizations* (New York: John Wiley, 1958).

⁶ R. Likert, *New Patterns of Management* (New York: McGraw-Hill, 1961); D. McGregor, *The Human Side of Enterprise* (New York: McGraw-Hill, 1960).

⁷ C. Argyris, *Integrating the Individual and the Organization* (New York: John Wiley, 1964).

organizational system into subsystems, each of which tends to develop particular attributes in relation to the requirements posed by its relevant external environment. Differentiation, as used here, includes the behavioral attributes of members of organizational subsystems; this represents a break with the classical definition of the term as simply the formal division of labor. *Integration* is defined as the process of achieving unity of effort among the various subsystems in the accomplishment of the organization's task. *Task* is defined as a complete input-transformation-output cycle involving at least the design, production, and distribution of some goods or services. By these definitions, the boundaries of organizations will not always coincide with their legal boundaries: some institutions, such as large corporations, encompass a number of organizations by our definition; while others, such as certain subcontractors, do not constitute a single complete organization.

It is helpful to look first at the relation between the development of specialized attributes of subsystems and the task of each subsystem in coping with the relevant segment of the external environment.⁸

The Organization and Its Environment

Since the primary concern was with the internal functioning of organizations, it appeared that one useful way to conceive of the environment of an organization was to look at it from the organization outward. This approach is based on the assumption that an organization is an active system which tends to reach out and order its otherwise overly complex surroundings so as to cope with them effectively. Then as the organization becomes differentiated into basic subsystems, it segments its environment into related sectors. As Brown has pointed out, industrial organizations usually become segmented into three essential major subsystems here

⁸ It is important to emphasize that in this study, no attempt was made to distinguish between the real attributes of the environment and management's perception of these attributes. W. Dill (Environment as an Influence on Managerial Autonomy, *Administrative Science Quarterly*, 2 (1958), 409-433) has pointed out that there may be a discrepancy between these, but we attempted to minimize this gap by selecting as research sites organizations which were pursuing quite similar strategies in the same industry, the assumption being that similar strategies imply similar perceptions of the environment.

termed basic subsystems to distinguish them from integrative subsystems. These are the sales subsystem, the production subsystem, and the research and development subsystem.⁹ By the definition given, this segmentation indicates that the organization is undertaking a whole task. In this division of tasks, the organization is also ordering its environment into three sectors: the market subenvironment, the technical-economic subenvironment, and the scientific subenvironment.¹⁰ It is readily apparent that each of these environments can range from highly dynamic to extremely stable. The importance of this variability can easily be obscured by the usual approach of thinking of an organization's environment as a single entity. Here, each major subsystem was seen as coping with its respective segment of the total external environment. It was hypothesized that each subsystem would tend to develop particular attributes which would be predictably related to characteristics of its relevant external environment.

It was hypothesized that four attributes of an organizational subsystem would vary with the relevant subenvironments. Although many other attributes of organizations could be related to the environment, prior research led to a special interest in structural attributes and the pattern of cognitive and normative orientations held by the members of each subsystem.

Degree of Structure. Prior experimental and field studies indicated that an important attribute of any subsystem that could be expected to be related to its relevant environment was its degree of *formalized structure*. Structure here refers to those aspects of behavior in organizations subject to pre-existing programs and controls. We wanted to compare the degree of formalized structure

⁹ W. Brown, *Explorations in Management* (London: Heinemann, 1960), pp. 143-145. This in no way denies that other functions such as finance and personnel are usually differentiated, do at times play critical roles, and have a concern for a sector of the organization's total environment.

¹⁰ The term technical-economic subenvironment refers to the environmental sector of relevance to the production subsystem. Production systems are concerned with processing technology and with environmental changes in them; however, they need not search the environment for all developments of technical relevance, only for those that also meet a second criterion of economic relevance. These dual criteria are suggested by the name of the sector, since both can markedly alter the characteristics of this subenvironment.

in different organizations and subsystems, that is, the extent of pre-existing programs and controls. Leavitt, as well as other researchers working with experimental groups, found that groups working on relatively simple and certain tasks tend to perform the task better when the groups had more structure (i.e., preplanned and limited communication nets), whereas groups working on uncertain, more complex tasks tended to perform better with less structured communication nets.¹¹ In field studies, Burns and Stalker found that organizations that were profitably coping with uncertain, changing environments had a low degree of formalized structure ("organic"), instead of the higher degree of structure ("mechanistic") associated with financial success in more certain environments.¹² Woodward also found a relationship between the nature of the task and the structure of the organization. More significantly she found that more profitable organizations tended to adopt structures consistent with the requirements of their technological environments.¹³ Similarly, Hall found that departments with routine tasks tended to have a higher degree of bureaucracy (structure) than departments with less certain tasks.¹⁴ These findings suggested that subsystems in any organization could be expected to develop different degrees of structure in relation to the certainty of their subenvironment. It was therefore, hypothesized that:

Hypothesis 1. The greater the certainty of the relevant subenvironment, the more formalized the structure of the subsystem.

Orientation of Members Toward Others. Moment and Zalezink, and Leader suggested a second attribute of subsystems that could be expected to be related to the task of coping with different sub-

¹¹ H. Leavitt, "Some Effects of Certain Communication Patterns on Group Performance," in E. Macoby *et al.* (eds.), *Readings in Social Psychology* (New York: Holt, Rinehart, and Winston, 1958), pp. 546-563.

¹² T. Burns and G. Stalker, *op. cit.*, pp. 1-10.

¹³ J. Woodward, *Management and Technology* (London: Her Majesty's Printing Office, 1958), pp. 16-24.

¹⁴ R. Hall, Intraorganizational Structure Variables, *Administrative Science Quarterly*, 9 (1962), 295-308.

environments.¹⁵ This is a cognitive and affective orientation toward the objects of work, which is manifested in a person's interpersonal style. The objects can be either people or inanimate tools and instruments, and the concern of members with them tends to polarize along a task-social dimension. Subsystem members in their interpersonal relationships will be primarily concerned with either task accomplishment or with social relationships. Fiedler in studies of group effectiveness found task-oriented leadership associated with effective task performance under the extreme conditions of high and low task certainty, while more socially oriented styles were associated with effective performance under conditions of moderate uncertainty.¹⁶ Although Fiedler was focusing particularly on leadership behavior, whereas the interest here is in the wider interpersonal orientation of members of an organizational unit, his findings are relevant if one recognizes that leadership behavior is closely related to the interpersonal norms of the unit in which the leader functions. Based on these earlier findings it was hypothesized that:

Hypothesis 2. Subsystems dealing with environments of moderate certainty will have members with more social interpersonal orientations, whereas subsystems coping with either very certain environments or very uncertain environments will have members with more task-oriented interpersonal orientations.

Time Orientation and Members. A third attribute of subsystems can best be understood by considering the definition of certainty used in conceptualizing the characteristics of the different subenvironments. Three indicators of subenvironmental certainty were used: the rate of change of conditions over time in the subenvironment, the certainty of information about conditions

¹⁵ D. Moment and A. Zaleznik, *Role Development and Interpersonal Competence* (Boston: Graduate School of Business Administration, Harvard University, 1963); and G. Leader, "The Determinants and Consequences of Interpersonal Competence in a Bank Setting" (Unpublished D.B.A. thesis, Graduate School of Business Administration, Harvard University, June, 1965).

¹⁶ F. Fiedler, Technical Report No. 10, Group Effectiveness Research Laboratory, Department of Psychology, University of Illinois, May, 1960. While Fiedler in published studies has referred to this dimension as directive-permissive, in a recent private conversation with one of the authors, he has indicated that the task-social dimension is a more appropriate way to conceptualize his findings.

in the subenvironment at any particular time, and the modal time span of definitive feedback from the subenvironment on the results of subsystem behavior. It was predicted that structure and interpersonal orientation would be related to all three environmental indicators, while the members' time orientation, the third subsystem attribute, would be related to the timespan of definitive feedback. For example, a production subsystem that received feedback about its efforts on an almost daily basis, could be expected to have members with a short-term orientation, whereas a research unit coping with a subenvironment where feedback might occur only on the completion of a project lasting well over a year would be apt to have members with a more long-term orientation. It was hypothesized that:

Hypothesis 3. The time orientations of subsystem members will vary directly with the modal time required to get definitive feedback from the relevant subenvironment.

This attribute has apparently not been empirically studied in organizations, but it has been used as an important dimension of the comparative study of cultures.¹⁷

Goal Orientation of Members. The fourth attribute that subsystems were expected to develop in relation to their subenvironments was the *goal orientation* of members. Following the empirical research done by Dearborn and Simon on this subject, it was hypothesized that:

Hypothesis 4. The members of a subsystem will develop a primary concern with the goals of coping with their particular subenvironment.¹⁸

Thus marketing managers could be expected to be more concerned with customer and competitor actions, while production execu-

¹⁷ F. Kluckhohn and F. Strodtbeck, *Variations in Value Orientations* (New York: Row, Peterson, 1961); W. Caudill, and H. Scarr, Japanese Value Orientations and Culture Change, *Ethnology*, 1 (1962), 53-91; C. McArthur, "Cultural Values as Determinants of Imaginal Productions," Unpublished Ph.D. thesis, Harvard University; abstract in *Journal of Abnormal and Social Psychology*, 50 (March 1955), 247-254.

¹⁸ D. Dearborn and H. Simon, Selective Perception: a Note on the Departmental Identification of Executives, *Sociometry*, 21 (1958), 140-144.

tives would be more oriented toward the operation of equipment and the actions of suppliers.

One might question whether the development of these four different attributes in subsystems is not so obvious as to make it unnecessary to test for them. The testing can be sufficiently justified, however, on the grounds of establishing a factual base line for the testing of more debatable hypotheses to be described shortly. Furthermore other factors can be expected to counteract the tendency of subsystems to become differentiated in relation to their relevant subenvironment. The only counterforce to be dealt with formally in this study is the tendency to reduce differences between subsystems to achieve integration between them. Finally, it needs to be emphasized again that the particular attributes selected for measurement and examination in this study are not the only ones related to differences in subenvironments. Other attributes were seriously explored for inclusion, but were excluded because of methodological problems. The first was the linguistic or semantic orientation of the subsystems. The specialized languages that develop around certain tasks and environments are reputed to complicate the relations between subsystems.¹⁹ The second was concerned with supplementing the goal-orientation attribute with a measure of the more latent value orientation of the subsystems, since some studies indicate that various motivational orientations toward achievement, power, or social rewards are related to environmental characteristics.²⁰ The four attributes selected for this study however, were considered both operationally feasible and based on prior research.

Relation Between Differentiation, Integration, and Organizational Performance

To understand the functioning of complex organizations, it is necessary not only to consider the state of differentiation in relation to properties of the environment, but also to understand the functioning of complex organizations, it is also necessary to understand the relationship between differentiation and integration,

¹⁹ J. March and H. Simon, *op. cit.*, pp. 162-163.

²⁰ D. McClelland, *The Achieving Society* (Princeton: D. Van Nostrand, 1961), pp. 266-267.

and how these are related to organizational performance. Ronken and Lawrence found that differences in assumptions (orientations) between groups were related to difficulties in achieving collaboration.²¹ Miller suggested that as clusters of roles developed in relation to differentiated tasks, problems would result in achieving integration.²² Both Seiler and Sherif reported findings that indicate a relationship between the degree to which members of two groups share norms, values, and/or superordinate goals, and the ability of the two groups to cooperate.²³ Similarly, March and Simon indicated that differences in goals and in perceptions of reality could be a condition for intergroup conflict.²⁴ On the basis of these prior studies it was predicted that the degree of differentiation between any pair of subsystems in the four measured attributes would be inversely related to the effectiveness of integration between them.

One other factor must be considered in examining the relationship between differentiation and integration within an organization, what March and Simon have identified as the "felt need for joint decision-making" or what is here termed the degree of "requisite integration";²⁵ that is, whether task characteristics make it possible for subsystems in an organization to operate independently of each other, or require continual collaboration in making decisions before a given subsystem may act? The greater the degree of requisite integration between two subsystems the more difficult it will be to achieve integration. Therefore only pairs of units with a similar degree of requisite integration were examined. It was hypothesized that:

Hypothesis 5. Within any organizational system, given a similar degree of requisite integration, the greater the degree of differentiation in

²¹ H. Ronken and P. Lawrence, *Administering Changes* (Boston: Harvard University Graduate School of Business Administration, 1952), p. 203.

²² E. Miller, *op. cit.*, p. 245.

²³ J. Seiler, Toward a Theory of Organization Congruent with Primary Group Concepts, *Behavioral Science*, 8 (July 1963), 190-198; J. Seiler, Diagnosing Interdepartmental Conflict, *Harvard Business Review*, 4 (September-October 1963), 121-132; M. Sherif, Superordinate Goals in the Reduction of Intergroup Conflict, *American Journal of Sociology*, 3 (1958), 356-394.

²⁴ J. March and H. Simon, *op. cit.*, pp. 121-129.

²⁵ *Ibid.*

subsystem attributes between pairs of subsystems, the less effective will be the integration achieved between them.

Several organizations were compared to gain some insight into the relationship between differentiation and integration, and the performance of an organization in a given industrial environment. Rice indicated that effective subsystem performance is related to the subsystem being well differentiated in relation to its "primary task."²⁶ This suggests that the performance of a subsystem will vary directly with the extent to which the subsystem realized the relationship hypothesized between its four internal attributes and the characteristics of its subenvironment; that is, subsystems in different organizations would vary in the *degree* to which they realize the predicted relationships, and it is this degree of congruence that is proposed as a predictor of subsystem performance. Moreover, it is clear that total organizational performance is also related to achieving the degree of integration between subsystems required for the overall organizational task of coping with the external environment. It was hypothesized, therefore, that:

Hypothesis 6. Overall performance in coping with the external environment will be related to there being a degree of differentiation among subsystems consistent with the requirements of their relevant subenvironments and a degree of integration consistent with requirements of the total environment.

This hypothesis, along with hypothesis 5, raises the question of how organizations confronted with environmental demands for high differentiation and close integration achieve both, if differentiation and integration are in fact antagonistic. This question was of particular interest, because the environment selected for this study made just such demands on the organizations studied.

Means of Achieving Integration

Much of the theorizing about integration has suggested that the achievement of integration is the task of top management. Barnard has indicated that this is one of the principal functions of

²⁶ A. Rice, *Productivity and Social Organization* (London: Tavistock, 1958), pp. 227-233.

an executive.²⁷ More recently, both Haire and Rice, among others, have made a similar point.²⁸ Although coordination is undoubtedly an important part of the top manager's job, there is considerable evidence that many organizational systems develop integrative devices in addition to the conventional hierarchy. Litterer recently suggested three main means of achieving integration: through the hierarchy, through administrative or control systems, and through voluntary activities.²⁹ It is our view that these "voluntary" activities, which managers at lower echelons develop to supplement the hierarchical and administrative systems, are becoming increasingly formalized. One has only to note the proliferation of coordinating departments (whether called new product, marketing, or planning departments), task forces, and cross-functional coordinating teams to find evidence that new formal devices are emerging to achieve coordination.

It was predicted that in the industry studied, the high degree of subsystem differentiation required and the environmental requirements for a high degree of integration between the differentiated subsystems would make integrative devices necessary for effective performance. Top managers in these organizations would not be able to deal with the many technical and market factors that had to be assimilated in making well-coordinated decisions. It was therefore hypothesized that:

Hypothesis 7. When the environment requires both a high degree of subsystem differentiation and a high degree of integration, integrative devices will tend to emerge.

The effectiveness of these integrative devices is questionable. Burns and Stalker reported that such devices observed in their study were not effective.³⁰ However, if an organization was both highly differentiated and highly integrated, and yet these two processes are antagonistic, then these integrative devices would

²⁷ C. Barnard, *The Functions of an Executive* (Cambridge, Mass.: Harvard University, 1938), pp. 136-137.

²⁸ M. Haire, *Modern Organization Theory* (New York: John Wiley, 1953), pp. 302-303; and A. Rice, *The Enterprise and Its Environment*, *op. cit.*, p. 35.

²⁹ J. Litterer, *The Analysis of Organizations* (New York: John Wiley, 1965).

³⁰ T. Burns and G. Stalker, *op. cit.*, p. 9.

have to be functioning effectively. This raised another question: If the presence and effective functioning of these devices was necessary for high system performance, what were some of the determinants of the effectiveness of these devices? Before this question can be answered, it is necessary to consider the findings about the relationship between differentiation and integration, and the relation of these to the ability of the organization to cope with its external environment.

RESEARCH FINDINGS

Research Setting

The six organizations studied were all operating in a chemical processing industry, which was characterized by relatively rapid technological change and product modification and innovation. According to top executives in these organizations, the dominant competitive issue confronting them was the development of new and improved products and processes in this rapidly changing environment. The organizations were selected for study because these environmental conditions, particularly the importance of innovation, seemed to require organizations to achieve a high degree of both differentiation and integration.³¹

Subenvironments. Since the six organizations were operating in the same environment, efforts to characterize this environment were limited to an examination of the requirements of the three subenvironments: the market subenvironment, the scientific subenvironment, and the technical-economic subenvironment. Data about these subenvironments were collected in interviews with the top executives in each organization.³² From these interviews it was

³¹ Although this study was conducted in one environment, the authors are currently expanding this research into several other environments in an effort to discover how effective performance under different environmental conditions is related to differentiation and integration.

³² While this was an admittedly crude method for characterizing these subenvironments, it seemed sufficient for this phase of the research. A more systematic method for obtaining data about the environment has since been developed in the form of a questionnaire. These data are being collected as part of the doctoral work of James S. Garrison and will be reported in his dissertation, now in progress. A preliminary analysis of these data strongly supports the findings about the environmental characteristics of this industry reported here.

Table 1. Ranking of subenvironments along three dimensions.

Subenvironment	Certainty of information	Rate of change	Time span of definitive feedback	Total
Science	1*	1.5	1	3.5
Market	2	1.5	2	5.5
Technical-economic	3	3	3	9

* 1—least certain or longest in time span; 3—most certain or shortest in time span.

concluded that the certainty of these subenvironments could be measured by: (1) the rate of change in environmental conditions, (2) the certainty of information at a given time about environmental conditions, and (3) the time span of definitive feedback from the environment. The ranking of each of the subenvironments along these three dimensions is presented in Table 1. The total score obtained by summing the three columns provides at least a crude estimate of the relative certainty of these subenvironments; science being the least certain and the technical-economic the most certain.

The scientific subenvironment was characterized by relatively uncertain information at any given time about the nature of the materials being investigated. This was further complicated by the rapid rate of change in knowledge; new materials and formulations continually being developed might antedate present methods and products. Definitive feedback from this subenvironment was only secured after a project was entirely completed; only then was there concrete evidence to evaluate the success of the organizations in coping with its scientific subenvironment.

The rate of change in the market subenvironment was also relatively high; however, the executives seemed to feel somewhat more certain about market information than about scientific data. They indicated that they received feedback from the market subenvironment on a regular basis, and often as frequently as once a week.

In the technical-economic subenvironment, there was much more certainty about conditions in this subenvironment at a given time than in the others. Machine capacities, raw material specifications, and similar conditions could be accurately assessed. Also the rate of change was less rapid, since processes change only after

thorough testing had indicated they were warranted economically as well as technically. Finally feedback from this subenvironment was very rapid; information about processing costs, quality, and the like, being available on a daily basis.

Requisite Integration. In addition to the characteristics of these subenvironments, interviews with the top executives also provided information on the requirements for integration in this environment. A high degree of integration was required primarily because of the necessity for developing new processes and products and constantly modifying old ones. The executives indicated that the requirement for effective integration was particularly acute between the sales and research subsystems and between the production and research subsystems, as well as between these units and the integrative departments intended to link them. Sales and research needed to maintain an effective liaison first, so that the sales subsystem could provide researchers with information about market needs and requirements; and second, so that the research subsystem could make sales and marketing managers aware of the characteristics of new products. In addition to this flow of technical information, a close bond was necessary to achieve relationships that motivated salesmen to sell new products and researchers to undertake scientific investigations to meet market requirements.

Similarly close collaboration was needed between production and research so that researchers would be aware of processing capabilities and limitations as they developed new and modified processes, while production personnel would understand how to set up and maintain new and modified processes. Here too, collaboration was required to maintain close interpersonal ties between these groups, so that researchers would be motivated to investigate processing problems, and production personnel would be receptive to changes in production processes originating in the research subsystem.

All the organizations studied had segmented the research subsystem further into two subsystems: one for applied research and the other for more fundamental long-range investigations. Of these two units, the fundamental research subsystem, both because of the longer time span of definitive feedback and the less certain information with which it dealt, was coping with the least certain

portion of the scientific subenvironment. Also, in each organization, an extra subsystem had been established to integrate the activities of the basic subsystems. These were one type of integrative device that was expected to emerge, and they will be discussed in more detail later.

The presence of two research subsystems and the integrative subsystem in each organization complicated the question of where high integration was required. In some of the organizations, the top executives indicated that integration was also required between the two research subsystems; in other organizations, this was not required. This depended largely on the function assigned to the integrative subsystem. Since we were interested in studying subsystems of equal requisite integration, attention was focused on the relationship between sales and applied research and between production and applied research, as well as the relation of these subsystems to the integrative subsystems, where high requisite integration was defined as necessary by all of the top executives. In determining which subsystems had comparable requisite integration with the fundamental-research subsystem, the special circumstances of each organization as defined by the top executives involved, served as a guide.

Attributes of Basic Subsystem and Requirements of Subenvironments

It was predicted that each of these basic subsystems would develop four attributes (structure, members' interpersonal orientation, members' orientation toward time, and members' orientation toward goals) in relation to the specific requirements of the relevant subenvironment, particularly its certainty.³³

Structure. To measure the structure of the subsystems, dimensions suggested by Hall, Woodward, Evans, and Burns and Stalker that could be operationally measured were used: the span of supervisory control, number of levels to a supervisor shared with other subsystems, the specificity of review of subsystem perfor-

³³ The data for this study were gathered in interviews and questionnaires with 216 managers, engineers, and scientists in six organizations. The number of individuals in each organization ranged from 30 to 40.

Table 2. Scales of structural characteristics.

Structural characteristics	Formalized Structure*			
	1	2	3	4
Average span of control	11–10 persons	9–8 persons	7–6 persons	5–3 persons
Number of levels to a shared superior	7 levels	8–9 levels	10–11 levels	12 levels
Time span of review of subsystem performance†	Less than once each month	Monthly	Weekly	Daily
Specificity of review of subsystem performance	General oral review	General written review	One or more general statistics	Detailed statistics
Importance of formal rules	No rules	Rules on minor routine procedures	Comprehensive rules on routine procedures and/or limited rules on operations	Comprehensive rules on all routine procedures and operations
Specificity of criteria for evaluation of role occupants	No formal evaluation	Formal evaluation—no fixed criteria	Formal evaluation—less than 5 criteria	Formal evaluation—detailed criteria—more than 5

* Scores from low to high formalized structure.

† Based on shortest review period.

mance, the frequency of review of subsystem performance, the specificity of review of individual performance, and the emphasis on formal rules and procedures.³⁴ The more levels to a shared superior, the tighter the span of control; the more frequent and specific the reviews, and the more emphasis given to rules, the higher the formalized structure of the particular subsystem. Data on these characteristics for each subsystem were gathered from organizational documents (organization charts, procedural manuals, and the like), or when these were not available, by interviewing subsystem managers about organizational practices.

A four-point scale, ranging from most controlling to least con-

³⁴ R. Hall, Intraorganizational Structural Variables, *Administrative Science Quarterly*, 9 (1962), 295–308; J. Woodward, *op. cit.*; T. Burns and G. Stalker, *op. cit.*; W. Evans, Indices of Hierarchical Structure of Industrial Organizations, *Management Sciences*, 9 (1963), 468–477.

Table 3. Subsystem structure scores ranked from low to high structure.*

Subsystem	Organizations					
	I	II	III	IV	V	VI
Fundamental research	(8) 1	(13) 1.5	(12) 1	(8) 1	(16) 1.5	(8) 1
Applied research	(16) 2.5	(13) 1.5	(13) 2	(16) 2	(16) 1.5	(15) 2
Sales	(16) 2.5	(17) 3	(17) 3	(18) 4	(19) 3	(16) 3.5
Production	(18) 4	(22) 4	(21) 4	(17) 3	(23) 4	(16) 3.5

* Number in parentheses is structure score: Low score indicates low structure; high score indicates high structure. Other numbers are rank order.

trolling, was developed for each structural characteristic (see Table 2), and a structural score was computed for each subsystem in all organizations by adding the scores on all six characteristics. While there was some variation within individual subsystem, scores for one characteristic were generally consistent with those for others. Although space precludes discussing all these scores in detail, the important finding was that subsystems within each organization did tend to rank from low to high structure in relation to the uncertainty of their subenvironments, as is apparent from Table 3.

Production, with a more certain subenvironment, tended to have the highest structure in all but one organization (IV). Fundamental-research subsystems tended to have the least structure. Sales subsystems with moderately certain tasks tended to be more structured than research subsystems, but usually less structured than production. Although these rankings were found within all organizations, it is important to emphasize (as the raw scores indicate), that the degree of structure varied considerably between organizations. For example, the fundamental research subsystems in organizations I, IV, and VI tended to be considerably less structured than the counterpart subsystems in the other three organizations. We will return to the significance of this point later.

These data indicate, as predicted, that subsystems tend to develop a degree of formalized structure related to the certainty of their relevant subenvironment. This also, of course, indicates that the subsystems within each of these organizations were differentiated from each other in their internal structure.

Table 4. Subsystem interpersonal scores ranked from task concern to social concern.*

Subsystem	Organizations						Average rank all organi- zations
	I	II	III	IV	V	VI	
Sales	(103) 2	(100) 1	(90) 2	(92) 2.5	(118) 1	(92) 2	1.8
Applied research	(85) 3	(96) 2	(86) 4	(99) 1	(93) 2.5	(98) 1	2.3
Fundamental research	(112) 1	(94) 3	(87) 3	(90) 2.5	(88) 4	(78) 4	2.9
Production	(71) 4	(83) 4	(98) 1	(83) 4	(93) 2.5	(90) 3	3.1

* Numbers in parentheses are mean scores: high score indicates social concern; low score indicates task concern. Other numbers indicate rank order from social to task.

Interpersonal Orientation. The interpersonal orientation of members of the several subsystems in these organizations was measured by using the Least Preferred Coworker instrument developed by Fiedler.³⁵ This semantic differential scale measures the respondent's interpersonal style on a continuum from primary concern with task accomplishment to primary concern with social relationships. The results are presented in Table 4.

Although the interpersonal orientation of the various subsystems were generally differentiated in a direction consistent with their environmental tasks, the relationship was not as clear as in the case of structure. The sales subsystem, with a moderately certain subenvironment, did tend to have members who preferred a more socially oriented interpersonal style. The data also suggest that production personnel, whose task was most certain, preferred a more task-oriented style. In five organizations, fundamental-research personnel, confronted with a highly uncertain subenvironment, seemed to prefer a more task-oriented style, though less intensively than production personnel.

The findings for the applied-research subsystems are even less clear. In some organizations, members of these subsystems preferred a more social orientation; in others, a task orientation. The explanation may be because the applied-research task in the six organizations differed more than the tasks of any of the other basic subsystems. In some organizations, the applied-research sub-

³⁵ See note 16.

Table 5. Dominant time orientation of basic subsystems.*

Subsystems	Organizations					
	I	II	III	IV	V	VI
Sales	S	S	S	S	S	M
Production	S	M	S	S	S	M
Applied research	M	L	S	L	L	L
Fundamental research	L	L	L	L	L	L

* S = one month or less; M = one month to one year; L = one year to five years.

system was doing long-range research; in other organizations it was directly involved in shortrange process development and technical service activities. This made it difficult to establish the subenvironmental requirements for applied research subsystems. It is also possible, as Fiedler has pointed out, that situational factors other than the nature of the task were also influencing the preferred interpersonal style in all of these subsystems.³⁶ Nevertheless, the findings about the interpersonal orientation of members of subsystems in these organizations appear to follow the curvilinear relationship consistent with their subenvironmental requirements, as interpreted by Fiedler's contingency model. The clearest evidence of this is seen in the average ranking of units for all six organizations.

Time Orientation of Members. The time orientation of members of the different units was measured with a question which asked for an estimate of the percentage of total time used working on activities affecting the organization's profits within a specific time period: less than one month, one month to one year, and one year to five years. The results (see Table 5) clearly support the prediction that the time orientation of members of each subsystem would be related to the time span of definitive feedback of the relevant subenvironment. Sales and production subsystems tended to have the shortest time orientations, consistent with the shorter time span of definitive feedback in the market and technical-economic subenvironments. The research subsystems tended to have a long-term time orientation, which was congruent with the longer time span of feedback in the scientific subenvironment.

³⁶ F. Fiedler, *op. cit.*

Table 6. Goal orientation of basic subsystems.*

Subsystem	Organizations					
	I	II	III	IV	V	VI
Sales	M	M	M	M	M	M
Production	TE	TE	TE	TE	TE	TE
Applied research	S	TE	TE	TE	TE	TE
Fundamental research	S	TE	TE	S	TE	S

* M = market; TE = technical-economic; S = science.

The time orientation of the applied-research subsystems was somewhat less consistent than that of the fundamental-research subsystems, which, again, seemed to be due to the differences in the division of the research task within each organization. For example, in organizations I and III the applied-research subsystem worked primarily on immediate customer and process problems, whereas in the other organizations they focused on more complex applied problems. Thus, in organizations I and III the members of the applied research subsystems tended to have more short-termed time horizons.

Goal Orientation of Members. Finally, it was predicted that each subsystem would develop a goal orientation toward its relevant subenvironment. A list of ten criteria which managers might consider in making decisions relevant to product and process innovation was developed to measure this goal orientation. Three of these criteria related to factors in each of the three subenvironments; for example, competitive action (market), processing costs (technical-economic), and developing new knowledge (scientific). One criterion, which was related to the total environment, was not used in this analysis. The respondents were asked to select from these ten criteria the three most important considerations in making decisions, and then the next three most important.

The primary goal orientation of the sales and production subsystems (see Table 6) was as predicted. Sales personnel were more concerned with the market subenvironment, whereas production personnel were concerned primarily with the technical-economic subenvironment. In five of the organizations, however, the research personnel in the applied-research subsystems were concerned mainly with the technical-economic subenvironment. Among the

fundamental-research subsystems the primary goal orientation was equally divided between the scientific subenvironment and the technical-economic subenvironment. This finding is not too surprising, since much of the activity of research subsystems was dealing with process improvements and modifications. However, where members indicated a primary goal orientation toward the technical-economic subenvironment, they also indicated a strong secondary orientation toward the scientific subenvironment. In goal orientations, then, the subsystems in these six organizations generally tended to develop a primary concern with their relevant subenvironment.

The basic subsystems were therefore differentiated in these four attributes, and the differentiation was generally in a direction consistent with predictions. Although these findings are not surprising, since they had been strongly suggested by earlier studies, they are important, because they suggest that these attributes within each subsystem are related to the particular requisites of the relevant subenvironment. They are also important because it was possible to measure these four attributes in each subsystem, at least crudely, so that the relationship of the differentiation in these four attributes to integration between the subsystems could be examined.

Differentiation and Integration within Organization

To test hypothesis 5, we measured the degree of differentiation in the four subsystem attributes between the pairs of subsystems with high requisite integration by computing the differences in each attribute score for each pair of relevant units. The range of differences for all six organizations in each attribute was divided into quintiles. Each quintile was assigned a "unit of differentiation" score from one (least differentiated quintile) to five (most differentiated quintile). These five-point units of differentiation scores for each attribute made it possible to arrive at a rough measure of the relative differentiation between pairs by summing the score for each pair of subsystems in all four attributes.

The effectiveness of integration was measured by asking respondents for their evaluation of the state of interdepartmental relations between all the pairs of subsystems, the evaluation being

Table 7. Relationship of differentiation and integration of subsystem pairs in six organizations.

Subsystem pairs	I		II		III	
	Units of dif-ferentiation*	Integration scores†	Units of dif-ferentiation	Integration scores	Units of dif-ferentiation	Integration scores
Integrative-production	12 (6)	2.47 (4)	11 (6)	2.60 (4)	10 (7)	2.78 (5)
Integrative-sales	6 (1)	1.91 (1)	9 (3)	2.19 (3)	6 (2)	2.32 (2)
Integrative-applied research	7 (2)	1.97 (2)	4 (1)	1.71 (1)	4 (1)	2.26 (1)
Integrative-fundamental research	11 (5)	2.72 (6)	9 (3)	2.80 (6)	8 (4.5)	3.00 (6)
Production-applied research	10 (3.5)	2.00 (3)	10 (5)	2.72 (5)	9 (6)	3.02 (7)
Sales-applied research	10 (3.5)	2.51 (5)	9 (3)	2.04 (2)	8 (4.5)	2.72 (4)
Production-fundamental research	19 (7)	2.95 (7)	15 (8)	3.05 (7)	13 (8)	3.04 (8)
Sales-fundamental research	-	-	14 (7)	3.07 (8)	-	-
Applied research-fundamental research	-	-	-	-	7 (3)	2.64 (3)

Table 7. (Continued.)

	IV		V		VI	
	Units of dif-ferentiation	Integration scores	Units of dif-ferentiation	Integration scores	Units of dif-ferentiation	Integration scores
Integrative-production	9 (4.5)	2.82 (4)	8 (3)	3.10 (3)	5 (1)	3.15 (3)
Integrative-sales	8 (2.5)	2.47 (3)	7 (2)	2.78 (2)	6 (3)	2.90 (2)
Integrative-applied research	8 (2.5)	2.43 (2)	6 (1)	2.76 (1)	6 (3)	3.50 (4)
Integrative-fundamental research	13 (7)	3.41 (7)	11 (5)	3.32 (5)	8 (6)	3.65 (6)
Production-applied research	7 (1)	2.40 (1)	9 (4)	3.12 (4)	6 (3)	2.72 (1)
Sales-applied research	9 (4.5)	3.42 (5)	13 (6)	3.46 (6)	7 (5)	3.55 (5)
Production-fundamental research	-	-	-	-	-	-
Sales-fundamental research	-	-	-	-	-	-
Applied research-fundamental research	10 (6)	3.55 (6)	-	-	11 (7)	4.10 (7)

* Low score indicates low degree of differentiation. Number in parentheses indicates rank order.

† Low score indicates effective integration. Level of significance of Spearman's coefficient of correlation between differentiation and integration is .05 for organization II and .01 for all others. Number in parentheses indicates rank order.

made on a seven-point scale ranging from "sound, full unity of effort in obtaining innovations is achieved," (1) to "couldn't be worse—bad relations—serious problems exist in getting innovations, which are not being solved" (7). In general, the respondents in all organizations tended to use only the upper part of this scale. It was possible to check the validity of responses to this question in interviews and it was found that mean scores of 2.5 or more for a pair of relationships seemed to indicate that there were appreciable difficulties in achieving integration.

The rank orders of these integration scores are compared with the rank orders of units of differentiation for the appropriate pairs of subsystems within each organization in Table 7. In all six organizations a significant relationship was found (Spearman's coefficient of rank correlation) between the rank order of the units of differentiation and the rank order of the effectiveness of integration. The more highly differentiated pairs of subsystems were encountering more difficulty in achieving integration than the less highly differentiated pairs, thus strongly supporting the hypothesis. This relationship was found in all six organizations for the total units of differentiation, but was not consistent for the units of differentiation in any one attribute. This suggests that it may be the sum effect of differences in orientations and differences in formalized structure between any two subsystems that is related to achieving effective integration, and not just a large difference in one attribute. Even a cursory inspection of the data in Table 7 indicates variations in the extent to which these organizations were differentiated and integrated. These variations in differentiation and integration between organizations are now examined to determine if, as predicted, they are related to organizational performance.

Relation of Differentiation and Integration, to Organizational Performance

It appeared from hypothesis 6 that with the different demands of the several subenvironments in this study and the requirement for high interdependence between parts of the organizations, effective organizations would be both more highly differentiated and more highly integrated than less effective organizations.

The mean differentiation and integration scores for the pairs of subsystems in each organization with high requisite integration were used as an index of the total differentiation and integration in each organization. One difficulty with this procedure is the slight differences in the six organizations as to the subsystems having high requisite integration with the fundamental-research subsystems. Since this subsystem was highly differentiated in all the organizations, then including an extra pair relationship with it could cause a significant variation in the mean differentiation score for any organization. In computing the mean scores, therefore, only the pairs of subsystems common to all six organizations were included: applied research with sales, applied research with production, and the integrative subsystem with sales, production, applied research, and fundamental research. The mean differentiation and integration scores for the six organizations were then divided into high, medium, and low classes.

Measures of Performance. As Seashore and others have indicated, it is difficult to measure organizational performance.³⁷ In the organizations studied it seemed desirable to use the conventional financial data used by management as measures of performance. Since these six organizations were operating in the same environment, a profitable and growing operation should be good evidence of effective coping with the environment. Some managers, however, considered the data on the actual rate of profit too confidential, therefore actual profitability data were not provided. It was possible however, to secure other indices of performance, such as: change in profits over the five years prior to the study; change in sales volume over the same period and percentage of current sales volume accounted for by products developed within the last five years (a measure of past success in innovation, and also an indicator of probable future effectiveness in maintaining volume and profits). The six organizations were ranked in each of these indices. (see Table 8). These rankings were then totaled as a crude measure of the total performance of the organization.

³⁷ S. Seashore, B. Indik, and B. Georgopoulos, Relationships Among Criteria of Job Performance, *Journal of Applied Psychology*, 44 (1960), 195-202.

Table 8. Organizational performance.*

Organi- zation	Change in profits	Change in sales volume	New products developed (% of current sales)	Total ranking†	Chief executives' subjective appraisals‡
I	2	3	1	6 (2)	2.5
II	1	1	3	5 (1)	2.5
III	3‡	2	4	9 (3)	1
IV	6	4	2	12 (4)	4
V	4	6	6	16 (6)	6
VI	5	5	5§	15 (5)	5

* Data from past 5 years, ranked from high to low performance.

† Spearman's rank-order correlation between the ranking of index totals (in parentheses) and the ranking of chief executives' subjective appraisal was significant at .05 level (corrected for ties).

‡ Had been operating at or near the break-even point during 5-year period. A small increase in profit made this index rise unrealistically in relation to all other organizations, so the average of the other two indices was used.

§ All products had been introduced in the past 5 years because operating only 5 years, therefore the average of the rankings for the other two indices was used.

As a check on the validity of these measures, the chief executive responsible for each organization was asked to indicate what percentage of an ideal 100 percent performance he thought his organization was achieving. These data were also ranked for the six organizations (see Table 8). The rank-order correlation between the chief executives' subjective appraisal and the index of performance suggests that the salient dimensions of total organizational performance were being measured, at least crudely.

The only significant variation between the chief executives' subjective appraisal and the empirical performance index was in organization III, where the chief executive, pleased at the performance of his organization in finally achieving a consistent, if small, profit, ranked his organization's performance higher than the other chief executives ranked theirs.

As a further check on these performance measures, interviews were held with the top two or three executives including the chief executive, in each organization. Data collected in these interviews were consistent with those reported in Table 8. In organizations I and II the top executives were pleased with past and current performance and felt the future looked even more promising.

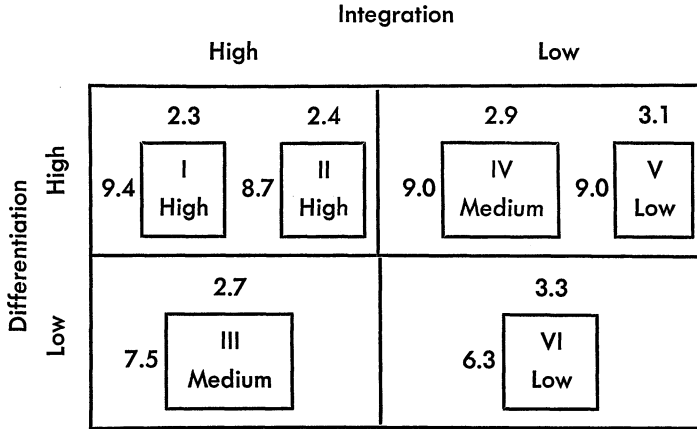


Figure 1. Differentiation, integration, and performance in the six organizations. Performance rankings are given in cells.

The top executives in organizations III and IV appraised the performance of their organizations more modestly. In organization III, the top executives indicated, that they had been through a difficult period, but in the current year the organization had begun an upward trend in performance, although they indicated a need for even greater improvement. Organization IV, according to its top executives had in the distant past (five to ten years before the study) been very effective and an industry leader. Its position had slipped in the ensuing years, but at the time of the study the executives felt the organization had reversed this unfavorable trend, although there was a need for greater improvement in performance. Organizations V and VI were both characterized by their top executives as having considerable difficulty in introducing and marketing new products. This together with other measures of performance gave the top executives a feeling of disquiet and a sense of urgency to find ways to improve performance.

Based on these evaluations and the data presented in Table 8, the organizations were divided into three performance categories: high (I and II), medium (III and IV), and low (V and VI). The organizations in each performance category were then compared in terms of their average differentiation and integration scores, as shown in Figure 1. It is clear from this figure that, as we had pre-

dicted, the two high-performing organizations had both the high differentiation and the high integration demanded by this environment.³⁸ The two medium-performing organizations (III and IV) were not achieving the required degree of differentiation or integration. Although organization IV had achieved high differentiation, it had relatively low integration. Organization III, which was achieving high integration, had the second lowest degree of differentiation. Organization VI, one of the two low performers had both the lowest degree of differentiation and the lowest degree of integration. The other low-performing organization (V) was achieving relatively high differentiation, but had very low integration.

Relation of Subsystem Attributes to Subenvironments. Despite this general support for the hypothesis about the relationship between differentiation, integration, and performance, it seemed of interest to get more details on the extent to which subsystems in the various organizations develop differential attributes that fit the demands of their subenvironments. In this analysis, it was necessary to exclude the applied-research subsystems, because of their variable function in the six organizations.

To determine whether the various subsystems met their subenvironmental demands in regard to structure, we trichotomized the structure scores for all subsystems. Fundamental-research subsystems were expected to fall in the lower third (less structured), sales subsystems in the middle third, and production subsystems the highest third. The interpersonal orientation scores were dichotomized: production and fundamental-research subsystems were expected to fall in the task half of the range, sales subsystems in the social half. As a test of whether the time and goal orientations of a subsystem were consistent with its subenvironmental demands, subsystems in the lower third of the range in orientation

³⁸ Using orthogonal comparisons, differences in integration scores between the high-performing organizations (I and II) and the low-performing organizations (V and VI) are significant at .01. Differences in integration scores between high-performing organizations (I and II) and medium-performing organizations (III and IV) are significant at .05. Differences between the medium-performing organizations (III and IV) and the low-performing organizations (V and VI) are only significant at .10. Because of the nature of the differentiation scores, calculations of significance would not be meaningful.

toward required time and goal dimensions were defined as not effecting a satisfactory fit.

The number of deviations from subenvironmental requirements in all four subsystem attributes was then calculated for subsystems in the high-performing organizations, which had 4 deviations and in the medium- and low-performing organizations, each of which had 10 deviations. The difference between the high and low performers and the high and medium performers is significant at $P = .05$ (Fischer's exact test). This provides further evidence that subsystems in the high-performing organizations were achieving differentiation that was more consistent with subenvironmental requirements than were subsystems in less effective organizations and that effective performance would be related to achieving both a degree of differentiation consistent with the requirements of the subenvironments and a degree of integration consistent with the requirements of the total environment. In this particular environment, this meant both high differentiation and high integration.

We are not suggesting, however, that other factors were not also influencing performance. Also no attempt was made to explore the causal influence of differentiation and integration on each other, yet some of the data gathered in interviews suggest that the interrelationship is complex. For example, in organization VI, which had both low differentiation and low integration, there was considerable evidence that certain subsystems (particularly the research subsystems) had such low differentiation that they were competing with each other in performing the same tasks. One interpretation would be that the competition resulting from the low degree of differentiation was contributing to the difficulties of achieving integration. Thus, in order to achieve higher integration this organization would first have to achieve clearer differentiation of the competing subsystems.

Most important, these findings confirm the importance of questions on how an organization can achieve both high differentiation and high integration when these are basically antagonistic states. Since the data supported the hypothesis that high differentiation between any pair of subsystems was related to low integration

between them, the question arises as to how organizations I and II maximized both states simultaneously. There is considerable evidence that many, if not most industries, will be increasingly characterized by dynamic, heterogeneous environments, as scientific advances continue and as markets and technologies become more complex. If high performance in such environments is at least partially related to attaining both high differentiation and high integration, it is clear that to be effective, the organization will have to achieve integration between specialists, while simultaneously encouraging increased differentiation.

ACHIEVING DIFFERENTIATION AND INTEGRATION

Emergence of Integrative Devices

Hypothesis 7 predicted the emergence of integrative devices. As indicated, in all the organizations except organization II, there were integrative subsystems whose members had the function of integrating the sales-research and the production-research subsystems. In organization II there was also a formally established integrative subsystem, but it functioned somewhat differently from the others and might be termed an integrative role set.

In addition to these integrative subsystems, four of these organizations (I, IV, V, and VI) had integrating teams with representatives from each of the basic subsystems and the integrative subsystems. The function of the teams was to facilitate the coordination of these activities of the various subsystems by providing formal machinery for discussing and resolving mutual problems.

Thus the hypothesis that integrative devices would emerge in organizations with environments which required both high differentiation and integration was confirmed; however, we were interested in examining these devices to understand the factors related to their effectiveness in achieving integration in the face of varying degrees of subsystem differentiation. Preliminary and prior research pointed to several factors that might be partial determinants of the effectiveness of these devices, and these were investigated further.

Structure and Orientation of Integrative Subsystem

It was predicted that one partial determinant of effective integrative devices would be that the orientations of members of the integrative subsystem would be intermediate between those found in subsystems they were to coordinate. An effective coordinator working between research and sales, for example, could be expected to be oriented equally toward long-term problems (the requisite time orientation of researchers) and short-term problems (the requisite time orientation of sales personnel) and to have an equal concern with market goals and scientific goals. Similarly, it was expected that effective coordinators would have interpersonal orientations between those of the groups they were linking. Finally, it was expected that the structure of the integrative subsystem would be intermediate between those of the basic subsystems being linked. This determinant was derived from the work of Sherif and of Seiler.³⁹

The methods used for measuring structure, and time, goal, and interpersonal orientations were also used for this analysis. The midpoint of the range of scores in each attribute was computed for the basic subsystems being integrated. The difference between the score for the integrative subsystem and the midpoint was then computed, to determine how closely the integrative subsystem approached an intermediate position.⁴⁰

These difference scores indicate that the integrative subsystem in organization I was the only one to be intermediate in all four

³⁹ J. Seiler, *op. cit.*; M. Sherif, *op. cit.*

⁴⁰ In structure and interpersonal orientation, where there was only a single mean score for each subsystem, this procedure was straightforward. However, since in time and goal orientations there were three dimensions to each attribute, the procedure was somewhat more complicated. In time orientation the differences in only short- and long-term orientations were considered, since these were the dimensions where the greatest differences existed in all six organizations. The differences in both dimensions were summed to get a single score. In goal orientation only those units which were concerned with a particular subenvironment were considered. For example, in orientation toward the marketing subenvironment, only the differences between the integrative unit and the sales and research subsystems were considered, since these were the units between which the integrative subsystem was providing a flow of marketing information. The differences in orientation toward the market, toward the scientific, and the technical-economic environment were then summed to get a single score.

Table 9. Intermediate position of integrative subsystems.*

Attribute	Organization					
	I	II	III	IV	V	VI
Structure	2.0 (+)	4.5 (—)	3.5 (—)	0.0 (+)	2.5 (—)	1.0 (+)
Interpersonal orientation	1.5 (+)	7.8 (—)	2.8 (+)	13.0 (—)	2.0 (+)	6.5 (—)
Time orientation	8.0 (+)	19.0 (+)	33.0 (—)	22.0 (+)	51.0 (—)	34.0 (—)
Goal orientation	.4 (+)	.5 (+)	.5 (+)	.7 (—)	.7 (—)	.5 (+)
Number of intermediate attributes	4	2	2	2	1	2

* The figures given are the differences between the midpoint of the range of basic subsystem scores in each attribute and the score of the integrative subsystem in each attribute. Since different scales have been used for each attribute, comparisons cannot be made between attributes; + indicates low difference in attribute as compared with other organizations; — indicates a high difference.

attributes, as indicated in Table 9. All other organizations, except organization V, appeared to be intermediate in two of the four attributes. Data gathered in interviews suggested that in all the organizations not intermediate in all four attributes (except organization II), the failure to meet this condition made it difficult for the members of the integrative subsystem to communicate effectively.

The time and goal orientations seemed to cause the most difficulty. Members of the basic subsystems in organizations III, V, and VI complained frequently that the members of the integrative subsystems, who were not intermediate in time orientation, were too preoccupied with current problems to be helpful in coordinating long-range activities. Typical comments from sales, production, and research personnel in these organizations follow:

I am no coordinator, but I can see that one of our troubles is that they [integrative] are so tied up in day-to-day detail that they can't look to the future. They are still concerned with '64 materials when they should be concerned with '65 markets.

We get lots of reports from them [the integrative subsystem] and we talk to them frequently. The trouble is that all they present to us [in research] are short-term needs. They aren't the long-range things we are interested in.

They [the integrative unit] only find out about problems when they find out somebody has quit buying our material and is buying some-

body else's, and this keeps you on the defense. A lot of our work is catch-up work. We would like more future-oriented work from them.

Similarly members of the basic units in organization IV and V frequently complained about the lack of balance in the goal orientation of the members of the integrative subsystem:

Our relations with them [the integrative subsystem] are good, but not as good as with research. They [integrative] are not as cost-conscious as the laboratory people. They are concerned with the customer.

He [the integrator] is under a lot of pressure to work with the salesmen on existing products in our product lines. What he [the integrator] should be and often tries to act like is a liaison person, but in reality he is not. He is too concerned with sales problems.

What's lacking is that they [the integrators] are so busy that they continually postpone working with research. They work closely with applied research on minor modifications, but the contact with basic research is minimal.

We are not implying that the other attributes (structure and interpersonal orientation) were unimportant, but only that they operated more outside the awareness of the members of the organization. In any case one can conclude from these data that organization I, with the most effective integration, had an integrative subsystem that was consistently intermediate in structure and orientation, whereas organizations II, III, IV, and VI had integrative subsystems that were only moderately intermediate, and organization V, a low-integration organization, had an integrative subsystem that was intermediate only to a very limited extent.

Influence Attributed to Integrative Subsystem

A second partial determinant of effective integrative devices was also derived from the work of Seiler, and from a preliminary analysis. Seiler reported that intergroup relations tend to be characterized by open collaboration when high-status groups were initiating for lower-status groups.⁴¹ Preliminary analysis suggested that many of the activities would be initiated by the integrative subsystem; therefore an effective integrative subsystem would be

⁴¹ J. Seiler, *Organization Theory and Primary Group Concepts*, *op. cit.*, 196-197.

perceived to be legitimate in initiating activities for the basic subsystems. Seiler had discussed this legitimacy in terms of status, but the internal organizational status of a subsystem can be measured in terms of the influence attributed to members of that subsystem by members of the rest of the organization. We thus predicted that the members of effective integrative subsystems would be perceived by other organizational members as having high influence in decision making relative to the members of other subsystems.

To measure the influence of the several subsystems, members of each organization were asked, "How much say or influence do you feel each of the units listed below has on product-innovation decisions?" Each subsystem was included, and responses were made on a five-point scale ranging from "little or no influence" to "a very great deal of influence." The mean scores for each subsystem within each organization were then ranked.

The integrative subsystem was ranked first out of the five subsystems, in organizations I, IV, and VI; second in organizations II and V, and tied for first ranking in organization III. Since all integrative subsystems appeared to have relatively high influence, it was concluded that this particular determinant did not discriminate among these organizations and it was not used further in this analysis.

Basis of Influence

A separate but related partial determinant is that the basis for influence be appropriate to the task of achieving integration. Influence can be based either on professional expertise or on hierarchical authority. As Blau and Scott have pointed out, influence based on hierarchical position is not appropriate where professional judgment is required for decisions related to coordination.⁴² In the organizations studied, where integration often had to be achieved around complex, unprogrammed problems involving technical issues, it was predicted that integrators whose influence stemmed from their professional competence would be more ef-

⁴² P. Blau and W. Scott, *Formal Organizations* (San Francisco: Chandler, 1962), p. 185.

fective than those whose influence was based on their position in the organization.

Data about the basis of influence was collected in interviews from responses to questions about the role of the integrative subsystem. In organizations I and II, the integrative personnel were seen as having influence primarily stemming from their knowledge and competence in dealing with problems associated with the environment. In the other organizations the influence of the integrative personnel was almost entirely attributed to their position.

Typical comments made by personnel in the basic subsystems in organizations I and II are:

He [the integrator] has a powerful job if he can get the people to work for him. A good man in that job has everybody's ear open to him. A good coordinator has to be thoroughly oriented to his market or to his process. Whichever area he is working in he has to be able to make good value judgments in his area.

The way we operate we feel that we get suggestions rather than directions from him [the integrator]. In my relations with him there is 100 percent freedom of action. He may tell me what to work on, but in the day-to-day operations I am never really aware of it.

We usually talk to him [the integrator] on the nature of two things. We are asking him that since we have such and such a material, how does it work as a new product? He might tell us what kind of product the market is looking for. We get a flow of information both ways.

They [the integrators] are the kingpins. They have a good feel for our [research's] ability and they know the needs of the market. They will work back and forth with us and the others.

It [the integrative subsystem] is on the border of research, so we work together closely. The integrative people are just a step away from the customer, so when I make a change in a material I let them know because they may have a customer who can use it. The good thing about our situation is that it [the integrative unit] is close enough to sales to know what they are doing and close enough to research to know what we are doing.

It is clear from these comments that the coordinators were seen as people who had knowledge about different aspects of the environ-

ment, and this knowledge appeared to be the basis of their high influence.

In the other four organizations, the comments about the integrator's role were quite different:

We [in the integrative subsystem] are in the thick of activities here. We are in control of the experimental material. When we feel that things are ready, we can transfer to sales. In this respect we are in the driver's seat.

We [in research] have to go by what they [the integrative subsystem] say. They have the upper hand. If we can't get their approval, we have to shut up.

He [an integrator] will tell you what material he thinks will work, and if you don't agree there isn't much you can do except beat your head against the wall and continue to work. If you aren't getting anywhere, then eventually he may listen to you.

We [the integrators] are staff men, but I like to feel we are line men. I take authority and initiative. If a salesman has a problem I go directly to him; then I tell his boss. When I talk to the laboratory director I like to feel I am his boss, even though the organization chart doesn't say so.

In setting up a coordinator, what you have done is set up a staff position where [the general manager] is able to go to a man and beat him on the head to get information and get things done.

A good coordinator is a guy with a red hot bayonet. He doesn't take no for an answer on anything. He also is in an enviable position since he reports to the general manager and he finds very little opposition to what he wants to do.

Nobody wants to pull the wool over the coordinator's eyes, since he reports to the general manager. That would be disastrous. I don't think anybody could be a coordinator and have many friends. You have to be too aggressive.

For a man to move into a coordinating role should be a big thing. But it isn't now. My guys can say "I know more than that guy [in the integrative subsystem]." People compare their skills and often the comparison is not favorable.

He [the integrator] is supposed to know the field and he may think our product isn't any good. This is fine if you have confidence in him, but we have had a bad experience with some of them. As the knowledge of chemistry grows, his [the integrator's] knowledge of the market must grow. I guess I would appraise the situation this way: just because they [integrators] have had twenty years' experience doesn't mean they have twenty years of knowledge.

In these organizations, the coordinators were seen as having influence stemming from their positions, either because of the formal authority of their position or because of their close proximity to top management; the only comments about the knowledge and competence of the coordinators tended to be negative ones. These excerpts from interviews suggest that organizations I and II met the hypothesized condition for good integration and the other four organizations did not.

Perceived Basis of Rewards for Integrators

A third partial determinant of effective integrative devices was suggested by the work of Zander and Wolfe.⁴³ They found that members of groups conditioned experimentally to be concerned with group performance, "generated more emphasis on providing successful scores for others and less concern about personal rewards or costs involved, more motivation to achieve a good score, more trust in others, and less strain in interpersonal relations."⁴⁴ On this basis, it was predicted that integrative devices would be most effective when the integrators perceived themselves to be rewarded for the performance of the total set of activities they were integrating; that is, effective integrators were expected to perceive that they were being rewarded for the achievement *with* others of a superordinate goal.

One of the questions included in the questionnaire asked respondents to select from a list of possible criteria for evaluation, the three most important factors used by their supervisors to evaluate their performance. The criteria used were: your own individual accomplishments, performance of your subordinates,

⁴³ A. Zander and D. Wolfe, Administrative Rewards and Coordination, *Administrative Science Quarterly* 9 (1964), 50-69.

⁴⁴ *Ibid.*

performance of the product group, how well you get along with others in your own department, and how well you get along with members of other departments. The respondents were asked to rank their three choices: most important (1) second most important (2), and least important (3). The mean score for the integrators in each organization was then computed. The criteria by which personnel were being evaluated indicated to them the basis on which they were being rewarded; therefore, the basis of evaluation may be used as a measure of the perceived basis of rewards.

The data indicated that integrative personnel in the two least integrated organizations V (with a score of 2.5) and VI (with a score of 3) saw themselves as being significantly less rewarded for the performance of the product group with which they were associated than did the integrators in organizations II (with a score of 1.8) and III (with a score of 1.1). Organizations V and VI were significantly different from organizations II and III at the .01 level. Although the difference between organizations V and VI and organizations I and IV (both with a mean score of 2.0) was not significant, it was clearly in the predicted direction. The integrators in organizations V and VI also perceived themselves to be significantly more rewarded for their individual performance than did the integrators in organizations III and IV. In organizations V and VI, then, this determinant was not present. In organizations II and III, two of the high-integration organizations, it was clearly operating; while in organizations I and IV, this determinant was operating to a moderate extent. From this, one can conclude that this factor generally discriminated between the organizations which were lowest in achieving integration and the other organizations.

Total Influence in the Organizational System.

The fourth partial determinant of effective integrative devices was derived from the work of Smith and Ari, who found a relationship between the total amount of perceived influence among organizational members and organizational effectiveness.⁴⁵ They

⁴⁵ C. Smith, and O. Ari, Organizational Structure and Member Consensus, *American Journal of Sociology*, 69 (May 1964), 623-638.

concluded that, "The significant exercise of control by both members and leaders leads to a high degree of identification and involvement in the organization." Horwitz's findings about influence and hostility carried this point a step further.⁴⁶ Organizations with subsystem members who feel that they have high influence in the organization would be likely to feel that their point of view was being given adequate weight by other groups and therefore would not feel hostility toward the members of other subsystems. This suggested that another factor related to effective integrative devices would be a high total amount of perceived influence in the organization.

The question used to determine the relative influence of the integrative subsystem was also used to derive the data for this determinant. The scores ranged from "little or no influence" (1) to "a very great influence" (5). Organizations I, II, and IV had mean influence scores of 3.6; organization III, a mean influence score of 3.5. The two organizations with the lowest integration scores—V with a total influence score of 2.5, and VI with a total influence score of 3.1—had significantly less total influence than the other four organizations. These two organizations were significantly different from the other organizations at the .05 level using an orthogonal comparison and did not meet this determinant.

Locus of Influence in Subsystems

A fifth partial determinant of effective integrative devices was also suggested by Smith and Ari. In the same study they predicted that "democratic" influence (high influence at lower levels of the organization) would be associated with high organizational performance.⁴⁷ Although their findings in the organization they studied did not support their hypotheses, they concluded that:

It is conceivable that a positively sloped distribution of control [high influence at lower echelons] might lead to a system of shared norms and consequently concerted action on the part of the organiza-

⁴⁶ M. Horwitz, "Hostility and Its Management in Classroom Groups," in W. W. Charters and N. L. Gage (eds.), *Readings in the Social Psychology of Education* (Boston: Allyn and Bacon, 1964), pp. 196-212.

⁴⁷ C. Smith and O. Ari, *op. cit.*, 623-638.

tion in a different type of organization with different organizational conditions. This might occur in a "mutual benefit" type of organization such as some voluntary organizations where the interests and objectives of members and leaders are more widely shared, and where decision-making is of a judgmental nature.⁴⁸

As these authors point out, Tannenbaum found that this condition was present in a voluntary organization.⁴⁹ Although the organizations we studied were not voluntary, they had managers and professionals at several levels of the organizational hierarchy whose interests and objectives might be more highly shared than in the organization studied by Smith and Ari. Furthermore, the environmental demands made it necessary to have the influence for decision making and conflict resolution at the management levels, where the knowledge about technical and market factors was available. We therefore predicted that another partial determinant of effective integrative devices would be the presence of a sufficient degree of influence to resolve interdepartmental conflicts at the level in each subsystem where the most knowledge about subenvironmental conditions was available; that is that better integration would be achieved if the persons who had the knowledge to make decisions also had sufficient influence to do so.

Data about the locus of pertinent knowledge was obtained in interviews with top managers in all six organizations. There was widespread agreement that in both the fundamental- and applied-research subsystems, the knowledge required to make product decisions was found among personnel at the lower levels of the organizational hierarchy. In the sales and production subsystems, where the subenvironment was more certain, the required knowledge was at the upper levels of the hierarchy. In the integrative subsystems, the respondents indicated that the required knowledge was to be found among members at the lower levels of the hierarchy. Since in all six organizations, high influence in the integrative subsystems was at the lower levels, as consistent with the

⁴⁸ *Ibid.*, 638.

⁴⁹ A. Tannenbaum, Control in Organizations: Individual Adjustment and Organizational Performance, *Administrative Science Quarterly*, 7 (1962), 236-257.

task requirements, the integrative subsystems were not considered in this analysis.

To measure influence in each subsystem, respondents were asked to indicate for their own subsystems, "How much say or influence each of the levels has on product innovation decisions?" The scale used was five points ranging from "little or no influence" to "a very great deal of influence." These data were analyzed to determine if the levels where influence was concentrated were also the levels with the required knowledge.

Organizations V and VI (the low-integration organizations) did not have the highest influence at the required level in two subsystems. In organization VI, influence was centered at too high a level in the applied-research subsystem and at too low a level in the production subsystem hierarchy.

In both the applied- and fundamental-research subsystems of organization V, the highest influence was too far up the organizational hierarchy. Organizations II, III, and IV each had one subsystem in which influence was not concentrated at the required level. In organization II influence was centered at too low a level in the production hierarchy. The concentrated influence in the applied research subsystem in organization III was at too high a level in the hierarchy, while in organization IV it was at too low a level in the sales hierarchy. In organization I the locus of high influence was consistent with the required knowledge in all four subsystems. Thus organization I, which achieved the highest integration, met this condition completely; organizations II, III, and IV met it partially, and organizations V and VI, with the lowest degree of integration, met it the least.

Modes of Conflict Resolution

The sixth determinant was suggested by the work of Blake and Mouton, who emphasized that the mode of conflict resolution used in organizations was an important variable in intergroup collaboration.⁵⁰ Initially they had identified five possible modes of resolving conflict: win-lose power struggle, smoothing over, withdrawal,

⁵⁰ R. Blake and J. Mouton, *The Managerial Grid* (Houston: Gulf Publishing Co., 1964).

compromise, or confrontation. They suggested that organizations placing greater emphasis on confrontation or problem-solving modes of conflict resolution would have effective intergroup relations.

In complex organizations having differentiated subsystems with different goals, norms, and orientations, it appeared that intergroup conflict would be an inevitable part of organizational life. The effective achievement of integration through the use of teams and other interpersonal contacts, therefore, would be closely related to the ability of the organization to resolve these conflicts. It was therefore predicted that the use of confrontation as the typical mode of conflict resolution would be an effective integrative procedure. The more confrontation and problem solving that occurred within an organization, the more effective would be its integrative procedures. Although this determinant is the last to be discussed it is not the least important. The differentiated subsystems often have quite different interests and objectives, so that the resolution of conflict between them may well be the most important function of integrative devices.

Limitations of space make it impossible to describe in detail the method used to measure the modes of conflict resolution, but a short description may be useful. The instrument to measure modes of conflict resolution used aphorisms or traditional proverbs, which described various methods of resolving conflict. It was assumed that these modes could be classified into the five types identified by Blake: confrontation, compromise, smoothing, forcing, and withdrawal, and the aphorisms were selected to match these modes.⁵¹ Aphorisms were used, because they represent folk wisdom about useful methods of handling conflict and because they avoided the use of biased phraseology and social science jargon.

Respondents indicated on a five-point scale (from "very typical behavior, usually occurs" to "behavior which never occurs") to what extent each of twenty-five aphorisms described typical ways of handling conflict in their organization. The data were factor analyzed using an orthogonal rotation. Three factors were identi-

⁵¹ R. Blake and J. Mouton, *op. cit.*

Table 10. Modes of conflict resolution.

Factor and aphorism	Factor loading
I. Forcing	
Might overcomes right.	.56
The arguments of the strongest have always the most weight.	.47
He who fights and runs away lives to run another day.	.45
If you cannot make a man think as you do make him do as you think.	.39
II. Smoothing	
Kill your enemies with kindness.	.42
Soft words win hard hearts.	.41
Smooth words make smooth ways.	.41
When one hits you with a stone hit him with a piece of cotton.	.38
III. Confrontation	
By digging and digging the truth is discovered.	.57
Seek till you find and you'll not lose your labor.	.50
A question must be decided by knowledge and not by numbers, if it is to have a right decision.	.41
Come now and let us reason together.	.41

fied and are presented in Table 10. Factor I described the forcing mode of conflict resolution while factor II described the smoothing mode and factor III described the confrontation mode. No other interpretable factors were present.

The scores for these three factors provide several important findings (see Table 11). Although all organizations used confrontation more than other modes, organizations I and II used confrontation to a significantly greater degree than the other organizations and organizations III and IV used it to a significantly greater extent than organizations V and VI. As predicted, the effectiveness of each organization in achieving integration seemed to be clearly related to the extent that its members relied on problem-solving behavior to resolve conflicts.

These data also provide an interesting additional finding. Organizations IV and VI were doing significantly more smoothing than the other organizations. Organizations III and VI were using significantly less forcing behavior than the other organizations. This, together with the data about smoothing, suggests that a large amount of smoothing behavior or a small amount of forcing behavior can also hinder effective integration. For example, organization VI, with the lowest integration, was not only doing less

*Table 11. Modes of conflict resolution.**

Organization	Factor		
	I. Forcing	II. Smoothing	III. Confrontation
I	9.5	8.9	13.0†
II	9.5	9.3	13.1†
III	9.1‡	9.0	12.4†
IV	9.7	9.8‡	12.0†
V	9.8	9.0	11.7†
VI	8.5	9.8‡	11.8†

* Higher scores indicate more typical behavior.

‡ Significantly different from other organizations at .01 level (orthogonal comparison).

† Pairs of organizations (I and II, III and IV, and V and VI significantly different from other organizations at .01 level (orthogonal comparison).

confrontation than the more effective organizations, but was also doing more smoothing and less forcing. This suggests that while heavy reliance on confrontation to handle conflict is important, it is also important to have a supporting mode of handling conflict which relies on some forcing behavior and a relative absence of smoothing behavior.

Summary

One of the main broad hypotheses of this study was that those organizations with integrative devices that more clearly met the six hypothesized partial determinants would be able to achieve both high integration and high differentiation, and that these in turn would be associated with high performance. All of the data relevant to this general hypothesis have now been presented and are summarized in Table 12. This indicates the extent to which organizations met the conditions for each of the six partial determinants. We have no adequate theory or empirical data at present to guide us in gauging the relative impact of each of these conditions on overall effectiveness of integration, nor on how these conditions affect one another. There certainly is no reason to think they are simply additive. However, the entire configuration of these conditions in relation to our measure of overall integration is highly suggestive of a close causal relationship. Experimental methods will probably be necessary to develop an understanding of these relationships further.

Table 12. Summary of partial determinants of effective integrative devices relative to differentiation, integration, and performance.

Organi- zation	Interme- diate position of integrative subsystem*	Influence of integrators derived from technical competence*	Integrators perceive rewards as related to total per- formance*	High influence throughout the orga- nization*	Influence centered at requi- site level*	Modes of conflict resolution	Degree of differen- tiation	Degree of integra- tion	System perform- ance
I	H	H	M	H	H	H	H (9.4)	H (2.3)	H
II	M	H	H	H	M	H	H (8.7)	H (2.4)	H
III	M	L	H	H	M	L	L (7.5)	H (2.7)	M
IV	M	L	M	H	M	L	H (9.0)	L (2.9)	M
V	L	L	L	L	L	M	H (9.0)	L (3.1)	L
VI	M	L	L	L	L	L	L (6.3)	L (3.3)	L

* H = high, M = medium, L = low; indicates relative extent to which each organization met this condition.

The relation between these six partial determinants and the degree of differentiation is not so clear. One can see by inspection that organizations I and II present patterns that fit the entire sequence of hypothesized relations very closely. They met most of the six conditions, achieved high differentiation as well as high integration, and were the two high companies in total system performance. This suggests that, as predicted, integrative devices that meet the six conditions tend to increase both overall integration and differentiation, which then leads to high performance in this industrial environment.

The data on organizations III and IV suggest that they achieved their medium level of overall performance by emphasizing different states. Organization III was the higher of the two in integration, but did not achieve a very high degree of differentiation. In contrast, organization IV seems to have emphasized achieving a fairly high degree of differentiation at the expense of integration. This kind of a potential exchange is, of course, consistent with our finding that these two states are essentially antagonistic.

The final pair (V and VI) were low in overall performance. Organization V achieved a higher degree of differentiation than is consistent with its failure to meet the six conditions and its level of performance, but its level of integration is consistent with these variables. This, along with the other data, suggests that integration is a better single predictor of performance than differentiation alone. Organization VI presents a pattern that is again consistent with all hypothesized relationships. It failed to meet almost all of the conditions for integrative devices that were predicted to be associated with high integration and differentiation, and is, in fact, the lowest company on both of these scores.

GENERAL CONCLUSIONS

In initiating this study the researchers wished to make a contribution to the theory of complex organizations based on empirical research. To do this, the study was designed to examine a fairly wide-ranging set of variables on a comparative basis in a set of complex organizations. It was necessary therefore to develop a number of new and relatively crude measures which were used

together with established ones. The research strategy was to attempt to relate such diverse variables as environmental characteristics and modes of conflict resolution in a single study, even at the expense of methodological nicety. This strategy made it possible to draw on a wide variety of earlier works to provide theoretical leads that could be tested further. Almost all previous findings, particularly in regard to achieving intergroup integration were given further support.

This study has demonstrated the feasibility and usefulness of simultaneously examining the differentiation and integration of major subsystems in complex organizations. This is of particular importance for future research. It clearly suggests the desirability of studying these phenomena under other environmental conditions to learn more about the relationship between organizational states and different environmental requirements.

This study also has a number of implications for practitioners concerned with administration of complex organizational systems. Increasingly, modern organizations are being expected to cope with heterogeneous environments that have both highly dynamic and quite stable sectors. While the advances of science are increasing the tempo of change in some subsystems the requirements for regularity and standardization remain in others. This continually increases the need for differentiation in organizations; yet the requirements for integration to achieve a unified effort are at least as great as ever. The findings of this study indicate that, other things being equal, differentiation and integration are essentially antagonistic, and that one can be obtained only at the expense of the other. Modern administrators are very familiar with this issue. They are constantly struggling with the difficulty of reconciling the need for specialization with the need for coordination of effort. But the data also provide some clues to the conditions that seem able to make it possible to achieve high differentiation and high integration simultaneously. These clues, in combination with an emerging methodological capacity to quantify states of differentiation, integration, and environmental attributes, provide concrete direction for the deliberate design of organizations that can cope more effectively with the turbulent environments that science and technology are creating.